Liquid Nitrogen

This Safety Bulletin is intended to remind users of the dangers associated with the use of liquid nitrogen (LN_2), including the risks of asphyxiation.

The **Three Most Important** things to remember are:

1. **DO NOT transport in a close vehicle, such as a car or van! There is no preliminary warning of oxygen deficiency and asphyxiation is usually sudden.**

2. **DO NOT seal the tanks inside any other containers! The use of any tight-fitting container or a stopper or plug that prevents the adequate venting of gas builds up pressure that could severely damage or even burst the containers.**

3. **DO NOT store LN2 in rooms or areas that are not properly ventilated. Since it cannot be detected by sight, taste or smell, it may be inhaled as if it were air.**

A little caution and a little common sense are needed for the safe handling of liquid nitrogen (LN_2). You should always be aware of two primary facts: ***LN_2 is extremely cold***. At atmospheric pressure, LN_2 boils at -196°C and ***LN_2 produces a large amount of gas***. One litre of LN_2 vaporizes into almost 680 litres of nitrogen gas. Either of these two properties can produce personal injury or property damage.

Do not allow objects cooled by LN_2 to touch your bare skin. Contact with the skin may cause serious frostbite. Because it is extremely cold, it can freeze human flesh almost instantaneously. Objects cooled by LN_2 may stick to the skin and tear flesh away when you attempt to remove the object. Use forceps or tongs to remove straws or canes from the storage container. Also, the eyes can be damaged by exposure to this gas even when the contact is too brief to affect the skin.

Protective clothing can reduce the hazards of handling LN_2. Insulated or heavy leather gloves and protective eyewear should always be worn when handling any object that has been in contact with LN_2. Loose fitting gloves are recommended so that they may be discarded quickly in the event that any LN_2 splashes into them. If you are working with open containers of LN_2, boots should be worn and trousers should not be tucked into the boots, but worn outside.

Special containers are required. Cryobiological storage containers are specifically designed and constructed to withstand the extreme temperature variances involved in handling LN_2. These special containers should be filled slowly to avoid the expansion stress that occurs as a result of the rapid cooling. Too much stress can damage the container.

Do not seal the containers. Cryobiological storage containers are designed to function with little or no internal pressure. The use of any tight-fitting stopper or plug that prevents the adequate venting of gas builds up pressure that could severely damage or even burst the container. Even icing or accumulated frost can interfere with proper venting and containers should be checked for such obstructions. To assure safe operations, only the original neck tube core or approved accessories for closing the neck tube should be used. In the event the cork becomes frozen in the neck (never have body or body parts directly over tank) a relief hole must be drilled through the middle of the cork before any attempt to remove the cork occurs like by melting ice build-up, heat lamp, hair dryer or similar means. Moisture can inherently cause lid assemblies to adhere to any dewar's neck assembly. The best way to avoid moisture build up is to wipe down the neck and lid areas each time it is opened. Unfortunately moisture is the enemy here; manufacturers do not provide a written procedure for a lid stuck frozen; this is a very potentially dangerous situation. The best method would be to allow the LN2 in the dewar to completely evaporate; hopefully this should allow the lid to thaw.

Transfer LN_2 with care. The primary hazards of transferring LN_2 from one container to another are spilling and splashing. Special funnels (with the top partially covered) will reduce splashing. For cryobiological storage containers a self pressurizing discharge device is available that allows controlled LN_2, withdrawal up to two litres per minute. Always follow carefully the instructions on containers or accessories when transferring LN_2. NEVER overfill the containers. Filling above the specified level is likely to produce spillage when the neck tube core is replaced.

Smaller leaks or spills from LN_2 containers in confined spaces (e.g. poorly ventilated small rooms) may give rise to lesser reductions in oxygen content, but they may still carry a risk of asphyxiation. The risk of asphyxiation must be assessed wherever LN_2 is used or stored, taking into account the volume present in relation to the room volume, the likelihood of leakage or spillage, the normal evaporative losses that occur with LN_2 use and any ventilation arrangements.

Use solid metal or wooden dipsticks. Because of the extremely low temperature of LN_2, certain plastic measuring devices tend to become very brittle or even shatter. Only use the approved measuring device that comes with the tank. NEVER use hollow rods or tubes; the gasification and expansion of the rapidly cooling liquid inside the tube will force liquid to spurt from the top of the tube. Always wear insulated or heavy gloves and eye protection when measuring.

Nitrogen gas is colorless, odorless, tasteless … and deadly! It reduces the concentration of oxygen and can cause suffocation. Since it cannot be detected by sight, taste or smell, it may be inhaled as if it were air. That is why LN_2 must always be stored, used or transported ONLY in areas that are fully ventilated. As LN_2 evaporates, the resulting nitrogen gas displaces the normal air-and breathing air that is less than 18% oxygen may cause dizziness, unconsciousness and even death. (Dizziness may lead to a fall. Cold nitrogen gas pools at floor level and therefore a fall may result in asphyxiation).

Transport containers with care. There is no preliminary warning of oxygen deficiency caused by the addition of nitrogen**.** This is a significant hazard, which has been responsible

for a number of deaths over the past few years. In these incidents, asphyxiation is usually sudden. The victims inhale air with little or no oxygen content, causing immediate collapse into a layer of dense, cold, nitrogen-enriched air. Unconsciousness followed rapidly by death is inevitable without immediate rescue and resuscitation. **LIQUID NITROGEN SHOULD NOT BE TRANSPORTED IN A CLOSED VEHICLE SUCH AS A CAR OR VAN.**

Handle containers with care. Containers should always be stored in an upright position. Tipping the container or letting it lie on its side can result in spillage and may damage the container or the materials stored in it. Dropping the container or subjecting it to severe vibrations may damage the vacuum insulation system. Walking or dragging containers could result in a partial or complete vacuum loss. For containers that cannot be easily and safely carried, a roller base can provide safe and easy movement of containers.

Container Contents. The extremely low temperature of the LN_2 or nitrogen gas provides the protection of the materials stored in cryobiological storage containers. When all of the LN_2 has evaporated, the temperature inside the container will rise slowly. The rate of evaporation depends upon the age, condition and use pattern of the container. Opening and closing the container or moving it about will reduce its cooling efficiency. You should check the LN_2 level in your containers at least weekly; make sure there is enough LN_2 in the container to maintain the required temperature to avoid damage to the straws stored in the container. If the liquid has evaporated faster than usual or if the container is covered with frost or condensation, the vacuum system may be damaged. In such instances, transfer the contents to another container at once.

First Aid:

INHALATION: Persons suffering from lack of oxygen should be moved to fresh air. If victim is not breathing, administer artificial respiration. If breathing is difficult, administer oxygen. Obtain prompt medical attention.

SKIN CONTACT: Remove any clothing that may restrict circulation to frozen area. Do not rub frozen parts as tissue damage may result. As soon as practical, place the affected area in a warm water bath which has a temperature not to exceed 105°F (40°C). Never use dry heat. Call a physician as soon as possible. Frozen tissue is painless and appears waxy with a possible yellow color. It will become swollen, painful, and prone to infection when thawed. If the frozen part of the body has been thawed, cover the area with dry sterile dressing with a large bulky protective covering, pending medical care. In case of massive exposure, remove clothing while showering with warm water. Call a physician.

EYE CONTACT: For exposure to liquid, immediately warm frostbite area with warm water (not to exceed 105°F).